DEPARTMENT OF ECOLOGY
Toxics Cleanup Program

August 24, 2010

TO: Jeanne Tran, P.E., Water Quality Program/Northwest Regional Office

FROM: Donna Podger, P.E., Toxics Cleanup Program/Aquatic Lands Cleanup Unit

SUBJECT: Puget Sound Naval Shipyard (NPDES Permit WA-000206-2) NPDES Permit Review and Mixing Zone Request, June 2010

Thank you for the opportunity to review the Puget Sound Naval Shipyard (PSNS) draft NPDES Permit WA-000206-2 and the request for a mixing zone. This permit covers stormwater and dry dock discharges from the Bremerton Naval Complex into Sinclair Inlet. There are six dry docks and approximately 150 stormwater outfalls. The permit is administered by the USEPA. Ecology provides a Water Quality Certification that the permit also complies with Washington State standards, including the Sediment Management Standards (SMS) WAC 173-204.[1]

Summary of Recommendation
Based on my review of existing data and information on this site, there is not enough information to determine if these discharges are in compliance with the SMS numeric criteria. Some sediment data from the past 10 years for mercury, zinc, copper and PCB show there are areas with elevated concentrations and exceedances of the SMS criteria. There are no recent data for other chemicals with SMS marine criteria. In areas where there is recent data and elevated concentrations, I recommend "diagnostic monitoring" to determine or rule out potential current sources of contamination. I also recommend additional sediment monitoring for the other chemicals with SMS marine criteria near the major outfalls (dry docks and 14 stormwater outfalls of concern identified by EPA) to determine compliance with the SMS.

Although a cleanup action was performed at this site in 2003, there are still many exceedances of the mercury sediment criteria. To a lesser extent, there are a few areas with exceedances of zinc, PCB, and copper. Based on spatial gradients, I have identified areas of concern for each of these contaminants. The existing stormwater monitoring data and the spatial resolution of the sediment data is not sufficient to determine or rule out potential sources of these contaminants. It is reasonable to believe that current ship maintenance, repair, and decommissioning are a potential source of these chemicals. It is possible that concentrations are related to historical activities and not current sources, but that has not been demonstrated. **Additional monitoring is needed to determine if current sources are controlled and not causing sediment contamination.**

Areas with higher concentrations of these constituents need "diagnostic monitoring" to determine if there are potential current sources of contaminants. The approach may include but not be limited to:

[1] Ecology 1995. *Sediment Management Standards WAC 173-204*. Revised December 1995. http://www.ecy.wa.gov/biblio/wac173204.html

- Increased discrete sediment sampling to evaluate spatial gradients.
- Review of upland and dockside activities and effectiveness of BMPs.
- Effluent monitoring of selected outfalls.
- Stormwater solids monitoring from storm drains or in-line sediment traps in selected areas.

I recommend that this "diagnostic monitoring" for mercury, zinc, copper and PCB be included in the NPDES permit.

Permit compliance with the SMS chemical criteria has not been demonstrated at this site. Although some metals and PCB have been monitored in the sediment, other chemicals have not. Sediment data from the 1990s indicated that PAH chemicals and phthalates may also be an issue at this site, but there is no recent data available. **I recommend that sediment samples be collected near the dry dock outfalls and 14 stormwater outfalls identified by EPA as special concern.** The sediment samples should be analyzed for the 47 chemicals with numeric criteria in the SMS and conventionals such as TOC, grain size, ammonia and sulfides.

The U.S. Navy has requested a mixing zone for copper and zinc in their NPDES permit for the dry dock and stormwater outfalls. The Navy has submitted a Mixing Zone report and All Known, Available, and Reasonable Methods of Treatment (AKART) study for consideration. Neither of these reports addresses potential impacts to sediment. Given the complexity of the site, the variability of the discharges, and the lack of data, I believe that a modeling effort would have a great deal of uncertainty. **I recommend that a mixing zone be allowed on the condition that there is sediment monitoring near the outfalls to evaluate if there are sediment impacts from the discharge.**

Background information, review of existing data and details are provided in this memo. If you have any questions, please email me at dpod461@ecy.wa.gov or call me at (360) 407-7016.

Regulatory Context

The purpose of this memo is to evaluate activities and discharges covered under this NPDES permit for compliance with the Washington Sediment Management Standards (SMS), and recommend additional monitoring that is needed to evaluate compliance. The SMS are promulgated under the Water Pollution Control Act chapter 90.48 RCW and the Model Toxics Control Act chapter 70.105D and are enforceable water quality standards. WAC 173-204-400 specifically gives Ecology authority to evaluate the potential for a waste discharge to cause a sediment impact, including permit requirements for monitoring. [1]

The SMS contains numeric criteria for 47 chemicals for the protection of benthic organisms in marine sediments of Puget Sound. The SMS contains two different levels of criteria for Puget Sound sediment.

- The **Sediment Quality Standards**, also known as **SQS,** correspond to sediment quality that will result in no adverse affects to biological resources or significant risk to human health. The SQS serve as the cleanup objective for all cleanup actions.

- The **Cleanup Screening Levels**, also known as **CSL**, Minimum Cleanup Levels (MCUL), or Maximum Chemical Criteria for Sediment Impact Zones (SIZmax), correspond to sediment quality that is the upper bound of minor adverse effects. The different names correspond to how the criteria are used in three different situations, but the criteria are the same.

If discharges result in sediment concentrations above the CSL criteria at a minimum of 3 stations, the site may become a candidate for cleanup actions. If discharges result in sediment concentrations below the CSL criteria, but above the SQS criteria, a Sediment Impact Zone may be needed for the discharge to be in compliance with the SMS.

The SMS allow for Sediment Impact Zones (**SIZ**) to be established via discharge permits or other administrative actions (WAC 173-204-415). There are a number of requirements for Sediment Impact Zones which include but are not limited to:

- The discharge receives all known, available and reasonable prevention, control and treatment.
- The sediment quality inside the SIZ does not exceed the minor effects standards (**SIZmax**).
- The discharger's activity is in the public interest.
- The SIZ area boundaries are the minimum practicable surface area.

Background

The Bremerton Naval Complex is located on 1,350 acres on the shoreline of Sinclair Inlet. The western portion of the site is occupied by the Bremerton Naval Station, which is largely residential and commercial activities and has piers that provide a homeport for aircraft carriers and supply ships. The eastern portion of the site is occupied by the Puget Sound Naval Shipyard, which is an industrial area that provides fueling, maintenance, overhaul and decommissioning of Navy vessels.

The general activities occurring at the Puget Sound Naval Shipyard include six dry docks for ship maintenance or decommissioning. Dry dock activities may include pressure washing/hydro blasting, dry abrasive blasting, and cutting up vessels for recycling using welding, cutting and grinding. Upland activities include various industrial processes to support the shipyard, including storage of scrap metal and hazardous materials.[2]

Site History

Bremerton Naval Complex became a permanent naval installation in 1891, and has been a source of contaminants since the early 1900s. Industrial activities and waste disposal practices of the past have resulted in soil, groundwater and sediment contamination. Areas of the site were filled with contaminated material.

Bremerton Naval Complex was formally listed on the National Priorities list in 1994, and the cleanup is overseen by the USEPA under CERCLA authority. The site was divided into five

[2] Draft Fact Sheet and Permit WA-000206-2. Working Draft May 2008.

operable units for remediation. Four of the units are upland. Operable Unit B-marine includes 230 acres of potentially contaminated sediments.

The Record of Decision (ROD) for a remediation action was signed in 2000. The remediation action included both remedial and navigational dredging of about 32 acres and disposal of contaminated sediments to an in-water Confined Aquatic Disposal (CAD) facility on the western side of the Operable Unit. Contaminated sediments were placed in a pit and then covered with clean material. The remedial action also included capping of 13 acres. Figure 1 shows the areas dredged and the location of the CAD.[3] Additional pier reconstruction has occurred since then.

Figure 1: Bremerton Naval Complex, including Puget Sound Naval Shipyard and Bremerton Naval Station. Map shows outfall and dry dock locations, and areas dredged in 2002-2003.

Description of Discharges

Discharges from the BNC that are covered under the NPDES permit include:

- 156 stormwater outfalls, 92 of these drain areas larger than 5,000 square feet.

[3] USEPA 2000. Final Record of Decision, Bremerton Naval Complex Operable Unit B Marine. EPA Publication EPA/ROD/R10-00/516. June 13, 2000. http://www.epa.gov/superfund/sites/rods/fulltext/r1000516.pdf.

- 1,043 open drains draining directly to Sinclair inlet with no piping. These are located primarily on the piers.
- Six dry docks discharging at four outfalls
- Steam generation plant
- Dockside activities such as underwater hull scraping that does not remove paint, and work performed on a vessel in the water that does not exceed 25% of the surface area of the vessel above the waterline.

No

Activities that are not covered under the NPDES permit:

- The site includes 10 piers and four moorings used for mooring navy vessels. Bilge water discharges from the ships, sacrificial anodes (zinc)[4] and leaching of hull paint (copper) are not covered.
- Many waste streams from the dry dock (including hydroblast water) are diverted to the Bremerton Wastewater Treatment Plant, where they are regulated under the State Waste Discharge Permit ST7374.

Process water from the dry docks (pressure wash water, dry dock wash down/cleaning, and hydroblast water) is required to be sent to the Bremerton Wastewater Treatment Plant (WWTP). Non-process water from the dry docks may include substantial volumes of non-contact cooling water discharged from the vessel, stormwater, and infiltrated groundwater and seawater. Dry dock discharges can be 2.5 to 7.1 MGD for combined outfalls of dry docks 1-5, and 4.5 to 13.6 MGD for dry dock 6.[5] Bremerton WWTP can accept all process water and up to 550,000 gallons per day of non-process water from the dry docks[6]. For non-process water, an automated turbidity sensor directs more turbid non-process water to the WWTP until the allowable limit is reached. Dry dock discharges have been monitored weekly in the past for copper, zinc, and lead. These dry dock discharges have not always been able to meet water quality criteria and existing effluent limits. The Navy has requested a mixing zone for copper and zinc in order to meet water quality standards from the discharge.

Stormwater has been monitored at this site only two times since the early 1990s. In each case 14 outfalls were sampled, but only five of those outfalls were in both monitoring events. Copper and zinc concentrations were frequently above water quality criteria, and mercury was occasionally above water quality criteria. It appears that only one outfall was sampled for PCB, and it was above the water quality criteria. The new draft permit includes future quarterly stormwater monitoring at 14 outfalls identified by EPA as outfalls of concern. The proposed monitoring includes stormwater samples be analyzed for copper, lead, mercury, zinc, arsenic, oil and grease, TSS, fecal coliform and turbidity.

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[4] Annual loading of zinc from Navy vessel sacrificial anodes is estimated at 2270 kg zinc/year. Copper leaching from Navy hulls was estimated at 877 kg Cu/year. From Brandenberger, J.M. and E.A Creclius 2008. *Contaminant Mass Balance for Sinclair and Dyes Inlets, Puget Sound, WA,* Battelle Marine Sciences Laboratory prepared for Puget Sound Naval Shipyard and Intermediate Maintenance Facility. April 2008.

[5] *All Known, Available, and Reasonable Methods of Treatment Study.* Prepared by Naval Facilities Engineering Command and Puget Sound Naval Shipyard and Intermediate Maintenance Facility. July 2009.

[6] State Waste Discharge Permit ST7374.

The CERCLA remediation action for Operable Unit B-terrestrial identified the stormwater system and erosion of shoreline areas as having the greatest potential for recontamination of the sediment. As part of the selected remedial action, the stormwater system was cleaned, inspected, and repaired to reduce infiltration of contaminated groundwater and soil. The shoreline areas were inspected and approximately 3,000 linear feet of riprap areas needed upgrading to prevent soil erosion.[7]

The Navy is requesting a mixing zone for the stormwater and dry dock discharges for copper and zinc. The mixing zone study evaluates only water column impacts and not sediment impacts. One requirement is an All Known, Available, and Reasonable Methods of Treatment (AKART) Study. AKART represents the most current methods of controlling pollutants from a discharge that can be installed or used at a reasonable cost. Determining water or sediment quality impacts from a discharge are not a component of the AKART study. The AKART study described several areas and BMPs that could be improved to meet or exceed the AKART standard. The list is too long to include in this memo, but generally includes:

- Additional oil/water separator for areas where crane, vehicle and equipment maintenance occurs.
- Covering areas where metal cutting and sorting occurs.
- Improving treatment for stormwater from the recycle materials transfer site.
- Improving BMPs so that anti-fouling paint is only sprayed in enclosed, covered areas.
- Improve piping, storage and oily water treatment systems for dry dock stormwater.
- Boiler blowdown and industrial drains from the steam plant will be redirected to the sanitary sewer.[8]

Sediment Data

The following chemicals are listed in the site Record of Decision (ROD) with sediment concentrations that exceed the Washington State Sediment Quality Standards (SQS) or Washington State Cleanup Screening Levels (CSL) for the protection of benthic organisms: total PCBs, total HPAH, total LPAH, arsenic, copper, lead, and zinc.[9] The ROD describes remedial actions based primarily on concentrations of PCBs in the sediment, although concentrations of mercury were also considered.[10] Dredging in 2002-2003 covered approximately 32 acres, including remedial dredging and navigational dredging. Post remediation monitoring for the CERCLA cleanup action occurred in 2003 (mercury and PCBs)[11], 2005 (mercury and PCBs)[12],

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[7] USEPA 2004. *EPA Superfund Record of Decision: Puget Sound Naval Shipyard Complex EPA ID: WA2170023418. OU5 Bremerton, WA. 3/8/2004.* EPA/ROD/R10-04/711.
[8] NAVFAC 2009. *All Known, Available, and Reasonable Methods of Treatment Study. Puget Sound Naval Shipyard and Intermediate Maintenance Facility.* July 2009.
[9] USEPA 2000. Record of Decision for Bremerton Naval Complex, OU B Marine. Table 6-1.
[10] USEPA 2000. Table 9-1.
[11] NAVFAC 2006a. Final 2003 Marine Monitoring Report. OU B Marine. Bremerton Naval Complex. Department of the Navy, Naval Facilities Engineering Command Northwest (NAVFAC).
[12] NAVFAC 2006b. Final 2005 Marine Monitoring Report. OU B Marine. Bremerton Naval Complex. Department of the Navy, Naval Facilities Engineering Command Northwest (NAVFAC).

and 2007 (mercury and PCBs).[13] Additional sediment monitoring has occurred in 2003(metals)[14], 2007(mercury)[15], 2007(copper, zinc, lead)[16] and 2008 (mercury and PCBs at Pier C and Pier 7).[17] PAH chemicals have not been monitored in the sediment since the remediation action.

Table 1 summarizes sediment data from 2003 to 2008. Some data were from Ecology's EIM database, and some were not in EIM nor available in electronic format. It was not possible to create a comprehensive map that included data not reported to EIM, but partial data maps are provided in Figures 2 through 7.

Table 1: Sediment Management Standards criteria (SQS and CSL) exceedances for zinc, copper, lead, mercury and PCB. The table includes available data in EIM and other reports or spreadsheets.

Chemical	Sediment Samples	Sediment Quality Standards (SQS)Exceedances	Cleanup Screening Level (CSL) Exceedances
Zinc (from EIM)	19	8	1
2007 Zinc (Figure 2)	74	6	1
Copper (from EIM)	19	2	2
2007 Copper (Figure 3)	74	2	2
2007 Lead	74	1	1
Mercury (from EIM) (Figure 5)	64	59	43
2003 OU B Marine Mercury (500-ft grid composites)	71	61	45
2005 OU B Marine Mercury (500-ft grid composites)	71	65	48
2007 OU B Marine Mercury (500-ft grid composites)	71	66	56
PCB (from EIM) (Figure 4)	29	4	2
2003 OU B Marine PCB (500-ft grid composites)	71	11	1
2005 OU B Marine PCB (500-ft grid composites)	71	10	1
2007 OU B Marine PCB (500-ft grid composites)	71	1	2

With the existing sediment data, there is evidence of elevated levels of mercury and zinc in the sediment, and to a lesser extent copper and PCB. There are no data for other constituents such as

[13] NAVFAC 2009. Final 2007 Marine Monitoring Report. OU B Marine. Bremerton Naval Complex. Department of the Navy, Naval Facilities Engineering Command Northwest (NAVFAC).
[14] EIM data from 2003. User Study ID *SCDMET03*.
[15] EIM data from 2007. User Study ID *USNSILTM*.
[16] Spreadsheet provided by Jeanne Tran, Ecology, *Sediment Data 03 07 r1.xlsx*.
[17] EIM data from 2008. User Study ID *09BNC*.

PAH chemicals. Most sediment samples are based on composite samples from three locations within a 500-foot grid area. Composite samples make it difficult to look at spatial patterns at a smaller scale that might indicate potential sources. Based on this existing data, as well as the limited monitoring of the stormwater discharges, it is not possible to determine the source of the elevated levels.

Zinc concentrations are above the SQS criteria in some areas in the eastern side of the site as shown in Figure 2. Out of 74 sediment samples, one composite sample was above the CSL criteria.

Copper concentrations are below the SQS criteria at most locations as shown in Figure 3. Some locations have elevated concentrations that are nearing the standard and two composite samples are above the standard. Copper is widely used in anti-fouling paints.

Mercury has widespread exceedances of the CSL standard as shown in Figures 4 and 5, and is being investigated under CERCLA authority. Based on the 2003, 2005, and 2007 OU B Marine Monitoring reports, there are several areas that have mercury concentrations that are noticeably higher than others– more than two times the CSL criteria. These include the following 500-ft grid cells: 34, 35, 39, 40 (near Pier D and Mooring E), and 59, 60, 63, 64, 67, 68 (near Piers 3, 4, 5 and 6) as shown by the ovals in Figure 5. Stormwater outfalls have had little monitoring for mercury in water or solids. In the past, anti-fouling paints used on ship bottoms have included up to ½ pound of mercuric oxide per gallon of paint.[18]

PCB concentrations in the 500-foot grid areas have greatly improved after the remediation project and have general trend downward across the site, except cells 30, 35, and 39, which have increased. The 2007 PCB data for these grid cells are shown in Figure 6. As shown in Figure 7, additional sediment monitoring at Pier 7 in 2007 also had two samples with very high concentrations of PCB, although PCB concentrations appear to be very heterogeneous in this area. Figure 7 shows the areas of concern for PCB from both the grid monitoring and the pier monitoring.

Stormwater outfalls have had essentially no monitoring for PCB in water or solid phase. In the past, PCB was widely used for top-side marine paints, with up to 25% PCB by weight.[19] It is possible that dockside activities such as top-side paint chipping or grinding has resulted in the discharge of PCB-laden paint particles near these piers and moorings. PCBs have also been used in building paints, caulk, roofing, siding, soundproofing felt in submarines, and electrical transformers. .

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[18] U.S. Naval Institute 1952. *Characteristics of Antifouling Coatings, Chapter 18 of Marine Fouling and Its Prevention.* Contribution No. 580 from the Woods Hole Oceanographic Institute. George Banta Publishing Co.
[19] USEPA 1999. 40 CFR Part 761. *Use Authorization for, and Distribution in Commerce of, Non-liquid Polychlorinated Biphenyls; Notice of Availability; Partial Reopening of Comment Period; Proposed Rule.* Federal Register December 10, 1999.

Figure 2: Zinc sediment concentrations 2007. Note composite samples have same result reported for each discrete sample location that made up the composite.

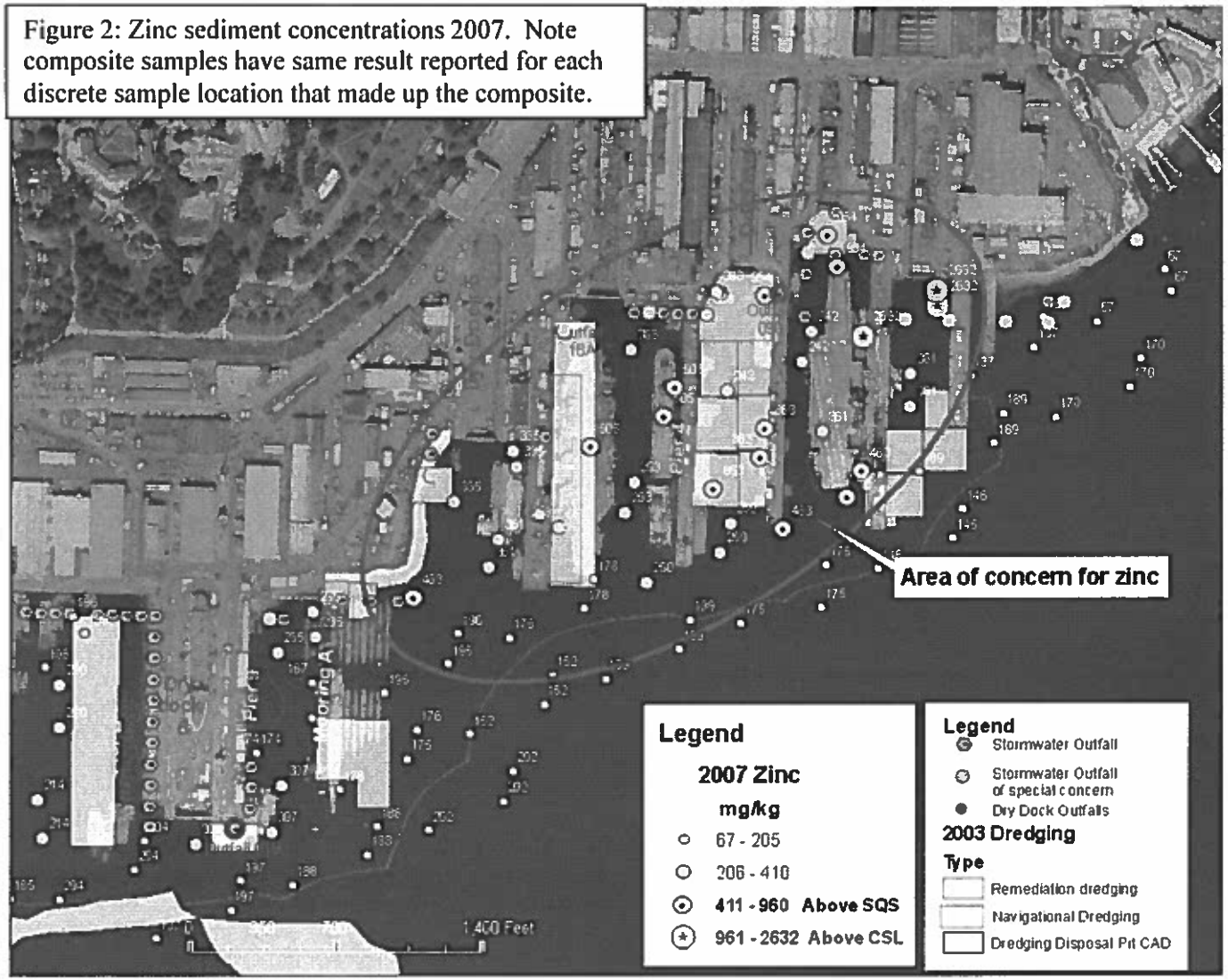


Figure 3: Copper sediment concentrations from 2007. Note composite samples have same result reported for each discrete sample location that made up the composite.

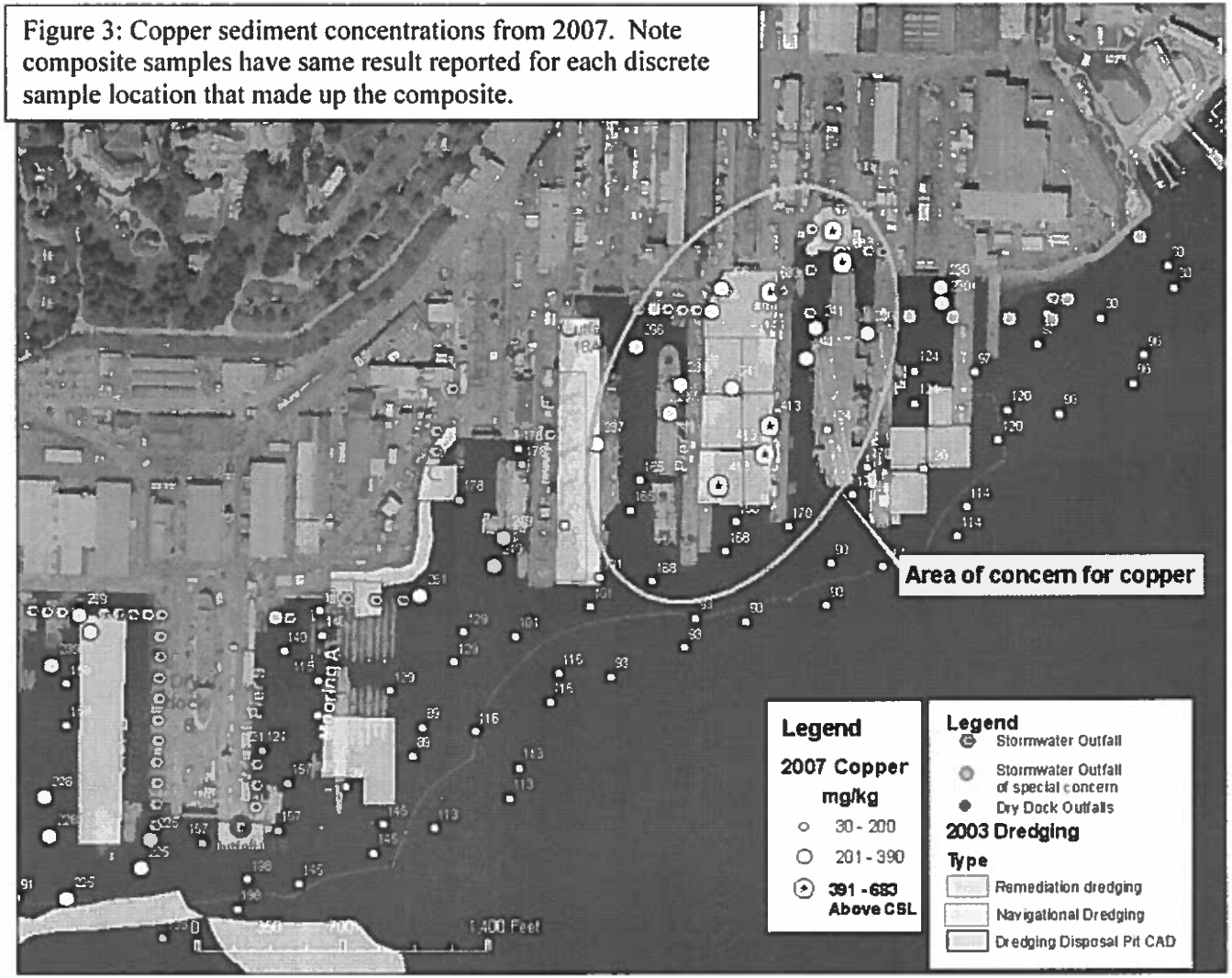


Figure 4: Mercury sediment concentrations from EIM 2007-2008.

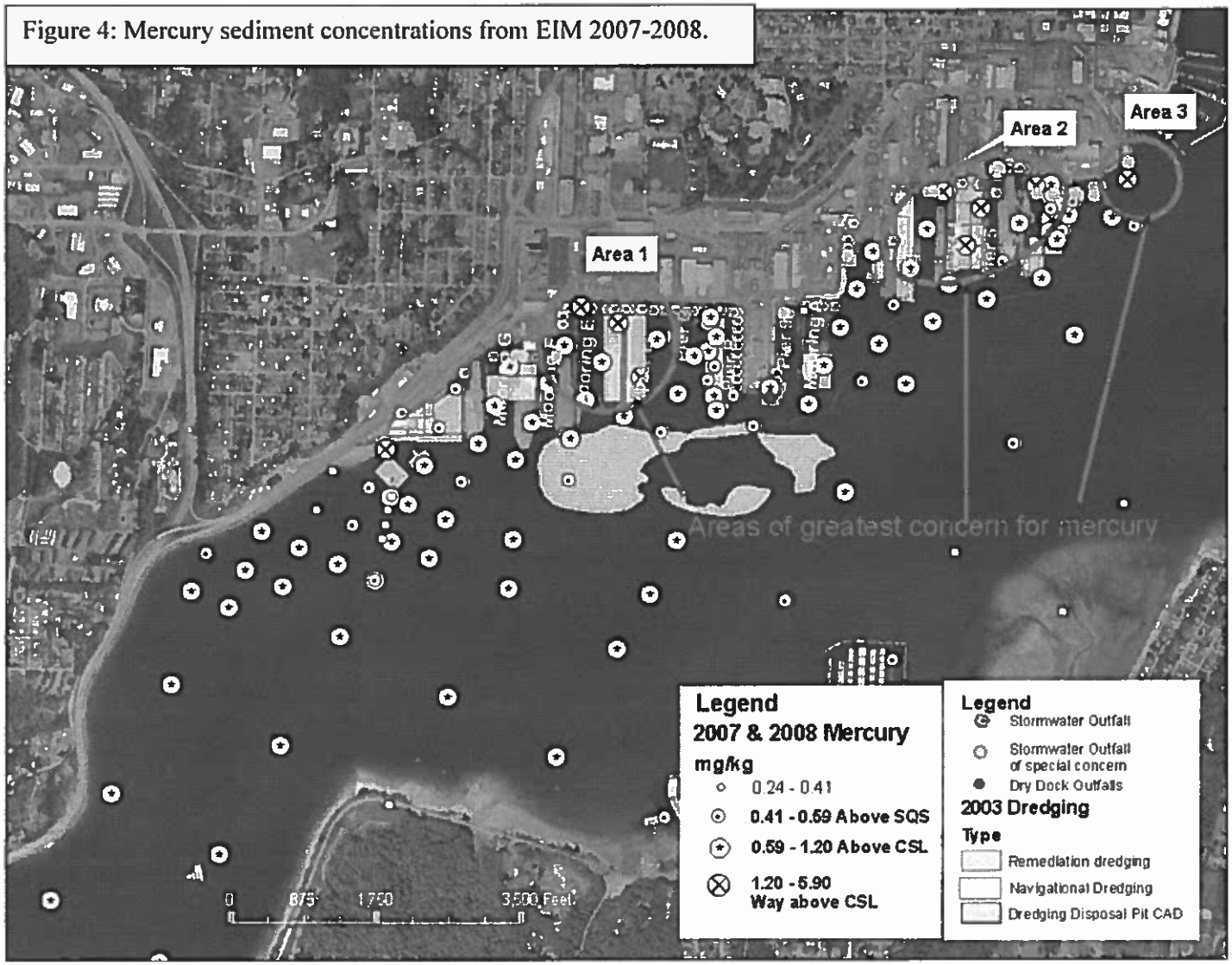
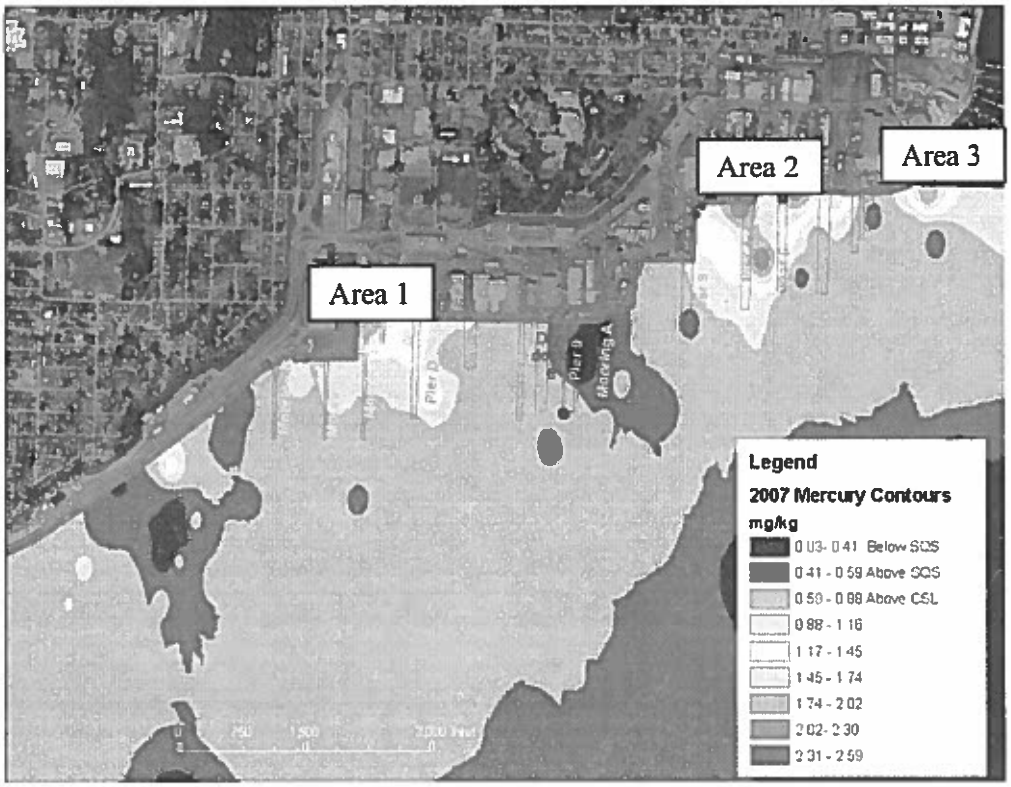


Figure 5: Priority areas to investigate potential mercury sources based on 2003-2007 OU B Marine Monitoring Reports.



Priority areas to investigate for mercury

Area 1

- Mooring E
- Pier D
- Stormwater Outfalls 13, 14, 37, 38, 39, 40, 41, 82, 83, 84, 85

Area 2

- Pier 4
- Pier 5
- Pier 6
- Stormwater Outfalls ***3***, 4, 5, ***6***, 7, ***25***, 26, 27, 28, 42, 43, ***44***, 35, 46, 48, 49, 50, 51, ***52***, 53, 97
- Dry dock Outfall 096

Area 3

- Stormwater Outfall ***1***

Bold italics indicates outfall identified by EPA as special concern.

In the past, anti-fouling paints used on ship bottoms have contained up to ½ pound of mercuric oxide per gallon of paint.

Figure 6: 2007 PCB sediment concentrations (dry weight) from EIM.

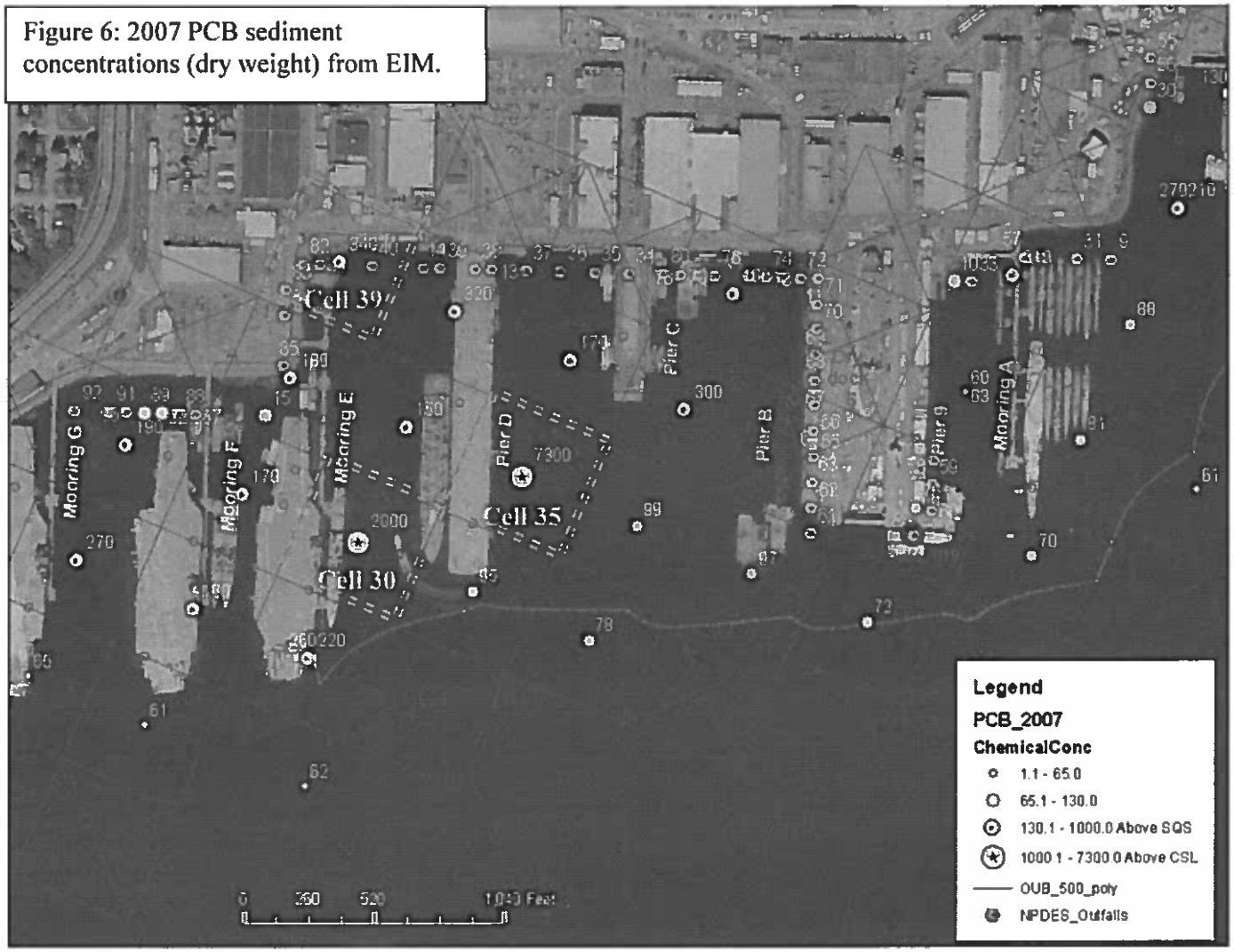
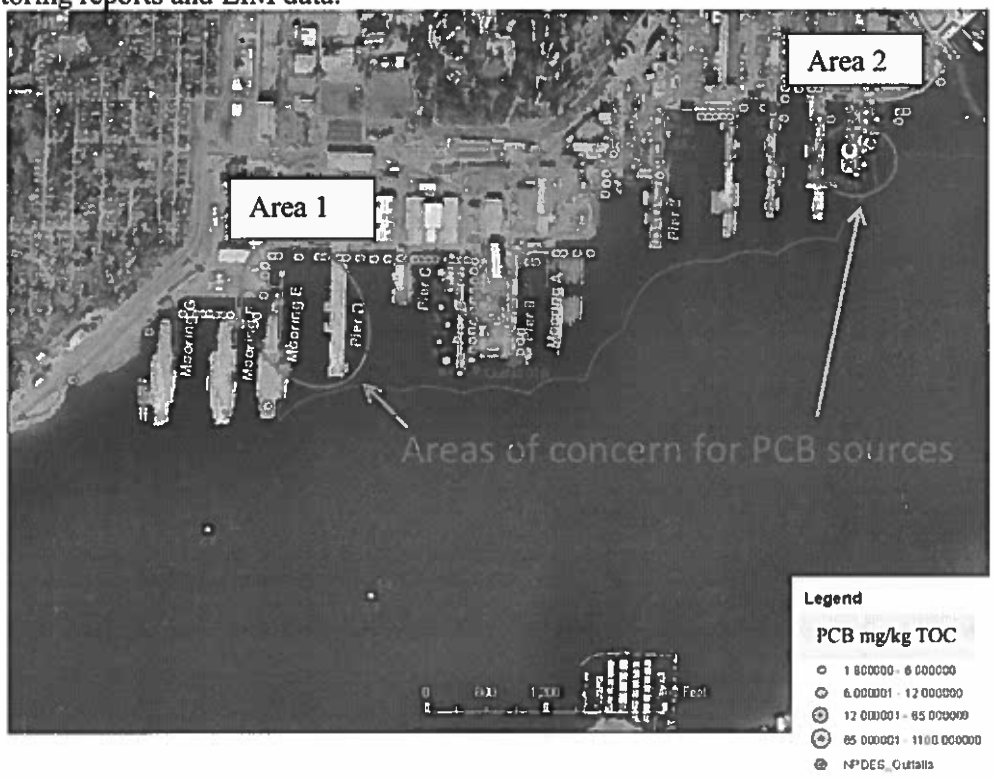


Figure 7: Priority areas to investigate potential PCB sources based on 2003-2007 OU B Marine Monitoring reports and EIM data.



Areas to Investigate for PCB

Area 1

- Pier D
- Mooring E
- Outfalls 13, 14*, ***15***, 38, 39, 40, 41, 82, 83, 84, 85.

Bold italics identifies outfalls of concern identified by EPA in permit.

* Outfall 14 has a very large drainage area – more than 4 million sq ft.

Area 2

- Pier 7
- Outfalls ***25, 95***.

Bold italics identifies outfalls of concern identified by EPA in permit.

Are there enough data to eliminate current ~~data &~~ activities & SW as potential sources?

Recommendation

Based on my review of existing information about site activities, discharge characteristics, and existing sediment data, I believe that additional monitoring is needed to determine the existence and extent of sediment impacts and the potential sources.

The request for a mixing zone in the water column seems reasonable, but it does not address impacts to sediment. Given the complexity of this site, the number of outfalls, and the lack of stormwater discharge data, I believe that an attempt to model sediment impacts would have a great deal of uncertainty. I recommend that you proceed with allowing a mixing zone for copper and zinc, but require sediment monitoring in the vicinity of the outfalls to determine if the discharges are causing sediment impacts. Sediment samples should be within 100 feet of the outfall and not be composited with other samples.

Sediment monitoring is also needed for other constituents that were identified in the ROD, such as PAH chemicals but has not been evaluated for more than 10 years.

Past stormwater discharge monitoring has been inadequate. I strongly agree with the new draft permit that requires quarterly monitoring of stormwater for copper, lead, mercury, zinc, and arsenic. This will help identify if the outfalls are potential sources of contaminants. Areas with elevated PCB or mercury concentrations, as identified in Figures 5 and 7, should have diagnostic monitoring such as stormwater sediment trap samples analyzed to evaluate possible upland sources.

Where sediment data shows exceedances of the SQS or CSL criteria for copper or zinc, laboratory bioassays may be used to evaluate whether the metals are bioavailable and causing toxicity. In areas of high copper and zinc concentrations, the overlying receiving water should be measured to evaluate whether the sediment could be a source of contamination that is causing water quality violations.

In areas where sediment concentrations exist above the SQS, additional diagnostic monitoring should be performed to determine potential sources. This may include additional sediment sampling to investigate spatial gradients, effluent monitoring at nearby outfalls, sediment trap analysis in basins that drain into the area, and evaluation of activities that may be contributing contaminants to stormwater in that area.

Below are recommendations for specific monitoring to include in the NPDES permit requirements:

Sediment Sampling

- One sediment sample within 100 feet of each of the 14 stormwater outfalls identified by EPA and at each dry dock outfall (18 samples total). The top 10 cm of sediment should

1/18/11
No current practices on Pier 7 to contribute to contamination.

be collected. These samples should be analyzed for the 47 chemicals with SMS numeric criteria, plus conventional analytes such as TOC, grain size, ammonia and sulfide.

- An additional 20 samples between Piers 3 and 7 to be analyzed for copper and zinc. These samples should be discrete sediment samples from 0-10 cm depth. The location of the samples should be distributed to help determine spatial gradients and potential sources.

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Effluent Monitoring

- Retain the quarterly stormwater monitoring that is currently in the draft permit, especially for outfalls in the eastern half of the site.
- Ensure that PCB and mercury are being evaluated in dry dock and stormwater monitoring, with a focus on areas of concern identified in Figures 5 and 7.
- In areas where BMPs are used to prevent contaminants in the stormwater, stormwater monitoring should be ongoing.
- In areas where BMPs are not an important part of pollution prevention, stormwater monitoring could be reduced once it is proven that there are low concentrations in the discharge.

Diagnostic Monitoring

- Piers 3, 4, 5, and 6 have SQS exceedances for zinc and also elevated concentrations of copper, as shown in Figures 2 and 3. Outfalls that discharge into this area should be evaluated as potential sources. A plan for evaluation and diagnostic monitoring should be developed and implemented for these discharges. The evaluation should include looking at what types of activities are occurring on the piers and in the stormwater catchment areas. For the most likely sources, diagnostic monitoring should include effluent monitoring, sediment catch basin monitoring, or additional sediment monitoring, as appropriate.
- Diagnostic monitoring should occur in areas with high concentrations of mercury and PCBs, as shown in Figures 5 and 7, to determine potential sources and prevent recontamination of cleanup actions. Diagnostic monitoring should include a review of area dockside and upland activities and applicable BMPs, effluent monitoring at identified outfalls, and stormwater solids monitoring (such as sediment traps), as appropriate.

cc: Nancy Harney, USEPA Region 10, Seattle
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Although a cleanup action was performed at this site in 2003, there are still many exceedances of the mercury sediment criteria. To a lesser extent, there are a few areas with exceedances of zinc, PCB, and copper. Based on spatial gradients, I have identified areas of concern for each of these contaminants. The existing stormwater monitoring data and the spatial resolution of the sediment data is not sufficient to determine or rule out potential sources of these contaminants. It is reasonable to believe that current ship maintenance, repair, and decommissioning are a potential source of these chemicals. It is possible that concentrations are related to historical activities and not current sources, but that has not been demonstrated. **Additional monitoring is needed to determine if current sources are controlled and not causing sediment contamination.**

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I recommend that this "diagnostic monitoring" for mercury, zinc, copper and PCB be included in the NPDES permit.

Permit compliance with the SMS chemical criteria has not been demonstrated at this site. Although some metals and PCB have been monitored in the sediment, other chemicals have not. Sediment data from the 1990s indicated that PAH chemicals and phthalates may also be an issue at this site, but there is no recent data available. **I recommend that sediment samples be collected near the dry dock outfalls and 14 stormwater outfalls identified by EPA as special concern.** The sediment samples should be analyzed for the 47 chemicals with numeric criteria in the SMS and conventionals such as TOC, grain size, ammonia and sulfides.

The U.S. Navy has requested a mixing zone for copper and zinc in their NPDES permit for the dry dock and stormwater outfalls. The Navy has submitted a Mixing Zone report and All Known, Available, and Reasonable Methods of Treatment (AKART) study for consideration. Neither of these reports addresses potential impacts to sediment. Given the complexity of the site, the variability of the discharges, and the lack of data, I believe that a modeling effort would have a great deal of uncertainty. **I recommend that a mixing zone be allowed on the condition that there is sediment monitoring near the outfalls to evaluate if there are sediment impacts from the discharge.**

Background information, review of existing data and details are provided in this memo. If you have any questions, please email me at dpod461@ecy.wa.gov or call me at (360) 407-7016.

Regulatory Context

The purpose of this memo is to evaluate activities and discharges covered under this NPDES permit for compliance with the Washington Sediment Management Standards (SMS), and recommend additional monitoring that is needed to evaluate compliance. The SMS are promulgated under the Water Pollution Control Act chapter 90.48 RCW and the Model Toxics Control Act chapter 70.105D and are enforceable water quality standards. WAC 173-204-400 specifically gives Ecology authority to evaluate the potential for a waste discharge to cause a sediment impact, including permit requirements for monitoring. [1]

The SMS contains numeric criteria for 47 chemicals for the protection of benthic organisms in marine sediments of Puget Sound. The SMS contains two different levels of criteria for Puget Sound sediment.

- The **Sediment Quality Standards**, also known as **SQS**, correspond to sediment quality that will result in no adverse affects to biological resources or significant risk to human health. The SQS serve as the cleanup objective for all cleanup actions.

- The **Cleanup Screening Levels**, also known as **CSL**, Minimum Cleanup Levels (MCUL), or Maximum Chemical Criteria for Sediment Impact Zones (SIZmax), correspond to sediment quality that is the upper bound of minor adverse effects. The different names correspond to how the criteria are used in three different situations, but the criteria are the same.

If discharges result in sediment concentrations above the CSL criteria at a minimum of 3 stations, the site may become a candidate for cleanup actions. If discharges result in sediment concentrations below the CSL criteria, but above the SQS criteria, a Sediment Impact Zone may be needed for the discharge to be in compliance with the SMS.

The SMS allow for Sediment Impact Zones (**SIZ**) to be established via discharge permits or other administrative actions (WAC 173-204-415). There are a number of requirements for Sediment Impact Zones which include but are not limited to:

- The discharge receives all known, available and reasonable prevention, control and treatment.
- The sediment quality inside the SIZ does not exceed the minor effects standards (**SIZmax**).
- The discharger's activity is in the public interest.
- The SIZ area boundaries are the minimum practicable surface area.

Background
The Bremerton Naval Complex is located on 1,350 acres on the shoreline of Sinclair Inlet. The western portion of the site is occupied by the Bremerton Naval Station, which is largely residential and commercial activities and has piers that provide a homeport for aircraft carriers and supply ships. The eastern portion of the site is occupied by the Puget Sound Naval Shipyard, which is an industrial area that provides fueling, maintenance, overhaul and decommissioning of Navy vessels.

The general activities occurring at the Puget Sound Naval Shipyard include six dry docks for ship maintenance or decommissioning. Dry dock activities may include pressure washing/hydro blasting, dry abrasive blasting, and cutting up vessels for recycling using welding, cutting and grinding. Upland activities include various industrial processes to support the shipyard, including storage of scrap metal and hazardous materials.[2]

Site History
Bremerton Naval Complex became a permanent naval installation in 1891, and has been a source of contaminants since the early 1900s. Industrial activities and waste disposal practices of the past have resulted in soil, groundwater and sediment contamination. Areas of the site were filled with contaminated material.

Bremerton Naval Complex was formally listed on the National Priorities list in 1994, and the cleanup is overseen by the USEPA under CERCLA authority. The site was divided into five

[2] Draft Fact Sheet and Permit WA-000206-2. Working Draft May 2008.

operable units for remediation. Four of the units are upland. Operable Unit B-marine includes 230 acres of potentially contaminated sediments.

The Record of Decision (ROD) for a remediation action was signed in 2000. The remediation action included both remedial and navigational dredging of about 32 acres and disposal of contaminated sediments to an in-water Confined Aquatic Disposal (CAD) facility on the western side of the Operable Unit. Contaminated sediments were placed in a pit and then covered with clean material. The remedial action also included capping of 13 acres. Figure 1 shows the areas dredged and the location of the CAD.[3] Additional pier reconstruction has occurred since then.

Figure 1: Bremerton Naval Complex, including Puget Sound Naval Shipyard and Bremerton Naval Station. Map shows outfall and dry dock locations, and areas dredged in 2002-2003.

Description of Discharges

Discharges from the BNC that are covered under the NPDES permit include:

- 156 stormwater outfalls, 92 of these drain areas larger than 5,000 square feet.

[3] USEPA 2000. Final Record of Decision, Bremerton Naval Complex Operable Unit B Marine. EPA Publication EPA/ROD/R10-00/516. June 13, 2000. http://www.epa.gov/superfund/sites/rods/fulltext/r1000516.pdf.

- 1,043 open drains draining directly to Sinclair inlet with no piping. These are located primarily on the piers.
- Six dry docks discharging at four outfalls
- Steam generation plant
- Dockside activities such as underwater hull scraping that does not remove paint, and work performed on a vessel in the water that does not exceed 25% of the surface area of the vessel above the waterline.

Activities that are not covered under the NPDES permit:

- The site includes 10 piers and four moorings used for mooring navy vessels. Bilge water discharges from the ships, sacrificial anodes (zinc)[4] and leaching of hull paint (copper) are not covered.
- Many waste streams from the dry dock (including hydroblast water) are diverted to the Bremerton Wastewater Treatment Plant, where they are regulated under the State Waste Discharge Permit ST7374.

Process water from the dry docks (pressure wash water, dry dock wash down/cleaning, and hydroblast water) is required to be sent to the Bremerton Wastewater Treatment Plant (WWTP). Non-process water from the dry docks may include substantial volumes of non-contact cooling water discharged from the vessel, stormwater, and infiltrated groundwater and seawater. Dry dock discharges can be 2.5 to 7.1 MGD for combined outfalls of dry docks 1-5, and 4.5 to 13.6 MGD for dry dock 6.[5] Bremerton WWTP can accept all process water and up to 550,000 gallons per day of non-process water from the dry docks[6]. For non-process water, an automated turbidity sensor directs more turbid non-process water to the WWTP until the allowable limit is reached. Dry dock discharges have been monitored weekly in the past for copper, zinc, and lead. These dry dock discharges have not always been able to meet water quality criteria and existing effluent limits. The Navy has requested a mixing zone for copper and zinc in order to meet water quality standards from the discharge.

Stormwater has been monitored at this site only two times since the early 1990s. In each case 14 outfalls were sampled, but only five of those outfalls were in both monitoring events. Copper and zinc concentrations were frequently above water quality criteria, and mercury was occasionally above water quality criteria. It appears that only one outfall was sampled for PCB, and it was above the water quality criteria. The new draft permit includes future quarterly stormwater monitoring at 14 outfalls identified by EPA as outfalls of concern. The proposed monitoring includes stormwater samples be analyzed for copper, lead, mercury, zinc, arsenic, oil and grease, TSS, fecal coliform and turbidity.

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[4] Annual loading of zinc from Navy vessel sacrificial anodes is estimated at 2270 kg zinc/year. Copper leaching from Navy hulls was estimated at 877 kg Cu/year. From Brandenberger, J.M. and E.A Creclius 2008. *Contaminant Mass Balance for Sinclair and Dyes Inlets, Puget Sound, WA*, Battelle Marine Sciences Laboratory prepared for Puget Sound Naval Shipyard and Intermediate Maintenance Facility. April 2008.

[5] *All Known, Available, and Reasonable Methods of Treatment Study.* Prepared by Naval Facilities Engineering Command and Puget Sound Naval Shipyard and Intermediate Maintenance Facility. July 2009.

[6] State Waste Discharge Permit ST7374.

The CERCLA remediation action for Operable Unit B-terrestrial identified the stormwater system and erosion of shoreline areas as having the greatest potential for recontamination of the sediment. As part of the selected remedial action, the stormwater system was cleaned, inspected, and repaired to reduce infiltration of contaminated groundwater and soil. The shoreline areas were inspected and approximately 3,000 linear feet of riprap areas needed upgrading to prevent soil erosion.[7]

The Navy is requesting a mixing zone for the stormwater and dry dock discharges for copper and zinc. The mixing zone study evaluates only water column impacts and not sediment impacts. One requirement is an All Known, Available, and Reasonable Methods of Treatment (AKART) Study. AKART represents the most current methods of controlling pollutants from a discharge that can be installed or used at a reasonable cost. Determining water or sediment quality impacts from a discharge are not a component of the AKART study. The AKART study described several areas and BMPs that could be improved to meet or exceed the AKART standard. The list is too long to include in this memo, but generally includes:

- Additional oil/water separator for areas where crane, vehicle and equipment maintenance occurs.
- Covering areas where metal cutting and sorting occurs.
- Improving treatment for stormwater from the recycle materials transfer site.
- Improving BMPs so that anti-fouling paint is only sprayed in enclosed, covered areas.
- Improve piping, storage and oily water treatment systems for dry dock stormwater.
- Boiler blowdown and industrial drains from the steam plant will be redirected to the sanitary sewer.[8]

Sediment Data

The following chemicals are listed in the site Record of Decision (ROD) with sediment concentrations that exceed the Washington State Sediment Quality Standards (SQS) or Washington State Cleanup Screening Levels (CSL) for the protection of benthic organisms: total PCBs, total HPAH, total LPAH, arsenic, copper, lead, and zinc.[9] The ROD describes remedial actions based primarily on concentrations of PCBs in the sediment, although concentrations of mercury were also considered.[10] Dredging in 2002-2003 covered approximately 32 acres, including remedial dredging and navigational dredging. Post remediation monitoring for the CERCLA cleanup action occurred in 2003 (mercury and PCBs)[11], 2005 (mercury and PCBs)[12],

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[7] USEPA 2004. *EPA Superfund Record of Decision: Puget Sound Naval Shipyard Complex EPA ID: WA2170023418. OU5 Bremerton, WA. 3/8/2004.* EPA/ROD/R10-04/711.
[8] NAVFAC 2009. *All Known, Available, and Reasonable Methods of Treatment Study. Puget Sound Naval Shipyard and Intermediate Maintenance Facility.* July 2009.
[9] USEPA 2000. Record of Decision for Bremerton Naval Complex, OU B Marine. Table 6-1.
[10] USEPA 2000. Table 9-1.
[11] NAVFAC 2006a. Final 2003 Marine Monitoring Report. OU B Marine. Bremerton Naval Complex. Department of the Navy, Naval Facilities Engineering Command Northwest (NAVFAC).
[12] NAVFAC 2006b. Final 2005 Marine Monitoring Report. OU B Marine. Bremerton Naval Complex. Department of the Navy, Naval Facilities Engineering Command Northwest (NAVFAC).

and 2007 (mercury and PCBs).[13] Additional sediment monitoring has occurred in 2003(metals)[14], 2007(mercury)[15], 2007(copper, zinc, lead)[16] and 2008 (mercury and PCBs at Pier C and Pier 7).[17] PAH chemicals have not been monitored in the sediment since the remediation action.

Table 1 summarizes sediment data from 2003 to 2008. Some data were from Ecology's EIM database, and some were not in EIM nor available in electronic format. It was not possible to create a comprehensive map that included data not reported to EIM, but partial data maps are provided in Figures 2 through 7.

Table 1: Sediment Management Standards criteria (SQS and CSL) exceedances for zinc, copper, lead, mercury and PCB. The table includes available data in EIM and other reports or spreadsheets.

Chemical	Sediment Samples	Sediment Quality Standards (SQS)Exceedances	Cleanup Screening Level (CSL) Exceedances
Zinc (from EIM)	19	8	1
2007 Zinc (Figure 2)	74	6	1
Copper (from EIM)	19	2	2
2007 Copper (Figure 3)	74	2	2
2007 Lead	74	1	1
Mercury (from EIM) (Figure 5)	64	59	43
2003 OU B Marine Mercury (500-ft grid composites)	71	61	45
2005 OU B Marine Mercury (500-ft grid composites)	71	65	48
2007 OU B Marine Mercury (500-ft grid composites)	71	66	56
PCB (from EIM) (Figure 4)	29	4	2
2003 OU B Marine PCB (500-ft grid composites)	71	11	1
2005 OU B Marine PCB (500-ft grid composites)	71	10	1
2007 OU B Marine PCB (500-ft grid composites)	71	1	2

With the existing sediment data, there is evidence of elevated levels of mercury and zinc in the sediment, and to a lesser extent copper and PCB. There are no data for other constituents such as

[13] NAVFAC 2009. Final 2007 Marine Monitoring Report. OU B Marine. Bremerton Naval Complex. Department of the Navy, Naval Facilities Engineering Command Northwest (NAVFAC).
[14] EIM data from 2003. User Study ID *SCDMET03*.
[15] EIM data from 2007. User Study ID *USNSILTM*.
[16] Spreadsheet provided by Jeanne Tran, Ecology, *Sediment Data 03 07 r1.xlsx*.
[17] EIM data from 2008. User Study ID *09BNC*.

PAH chemicals. Most sediment samples are based on composite samples from three locations within a 500-foot grid area. Composite samples make it difficult to look at spatial patterns at a smaller scale that might indicate potential sources. Based on this existing data, as well as the limited monitoring of the stormwater discharges, it is not possible to determine the source of the elevated levels.

Zinc concentrations are above the SQS criteria in some areas in the eastern side of the site as shown in Figure 2. Out of 74 sediment samples, one composite sample was above the CSL criteria.

Copper concentrations are below the SQS criteria at most locations as shown in Figure 3. Some locations have elevated concentrations that are nearing the standard and two composite samples are above the standard. Copper is widely used in anti-fouling paints.

Mercury has widespread exceedances of the CSL standard as shown in Figures 4 and 5, and is being investigated under CERCLA authority. Based on the 2003, 2005, and 2007 OU B Marine Monitoring reports, there are several areas that have mercury concentrations that are noticeably higher than others– more than two times the CSL criteria. These include the following 500-ft grid cells: 34, 35, 39, 40 (near Pier D and Mooring E), and 59, 60, 63, 64, 67, 68 (near Piers 3, 4, 5 and 6) as shown by the ovals in Figure 5. Stormwater outfalls have had little monitoring for mercury in water or solids. In the past, anti-fouling paints used on ship bottoms have included up to ½ pound of mercuric oxide per gallon of paint.[18]

PCB concentrations in the 500-foot grid areas have greatly improved after the remediation project and have general trend downward across the site, except cells 30, 35, and 39, which have increased. The 2007 PCB data for these grid cells are shown in Figure 6. As shown in Figure 7, additional sediment monitoring at Pier 7 in 2007 also had two samples with very high concentrations of PCB, although PCB concentrations appear to be very heterogeneous in this area. Figure 7 shows the areas of concern for PCB from both the grid monitoring and the pier monitoring.

Stormwater outfalls have had essentially no monitoring for PCB in water or solid phase. In the past, PCB was widely used for top-side marine paints, with up to 25% PCB by weight.[19] It is possible that dockside activities such as top-side paint chipping or grinding has resulted in the discharge of PCB-laden paint particles near these piers and moorings. PCBs have also been used in building paints, caulk, roofing, siding, soundproofing felt in submarines, and electrical transformers. .

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[18] U.S. Naval Institute 1952. *Characteristics of Antifouling Coatings, Chapter 18 of Marine Fouling and Its Prevention.* Contribution No. 580 from the Woods Hole Oceanographic Institute. George Banta Publishing Co.
[19] USEPA 1999. 40 CFR Part 761. *Use Authorization for, and Distribution in Commerce of, Non-liquid Polychlorinated Biphenyls; Notice of Availability; Partial Reopening of Comment Period; Proposed Rule.* Federal Register December 10, 1999.

Figure 2: Zinc sediment concentrations 2007. Note composite samples have same result reported for each discrete sample location that made up the composite.

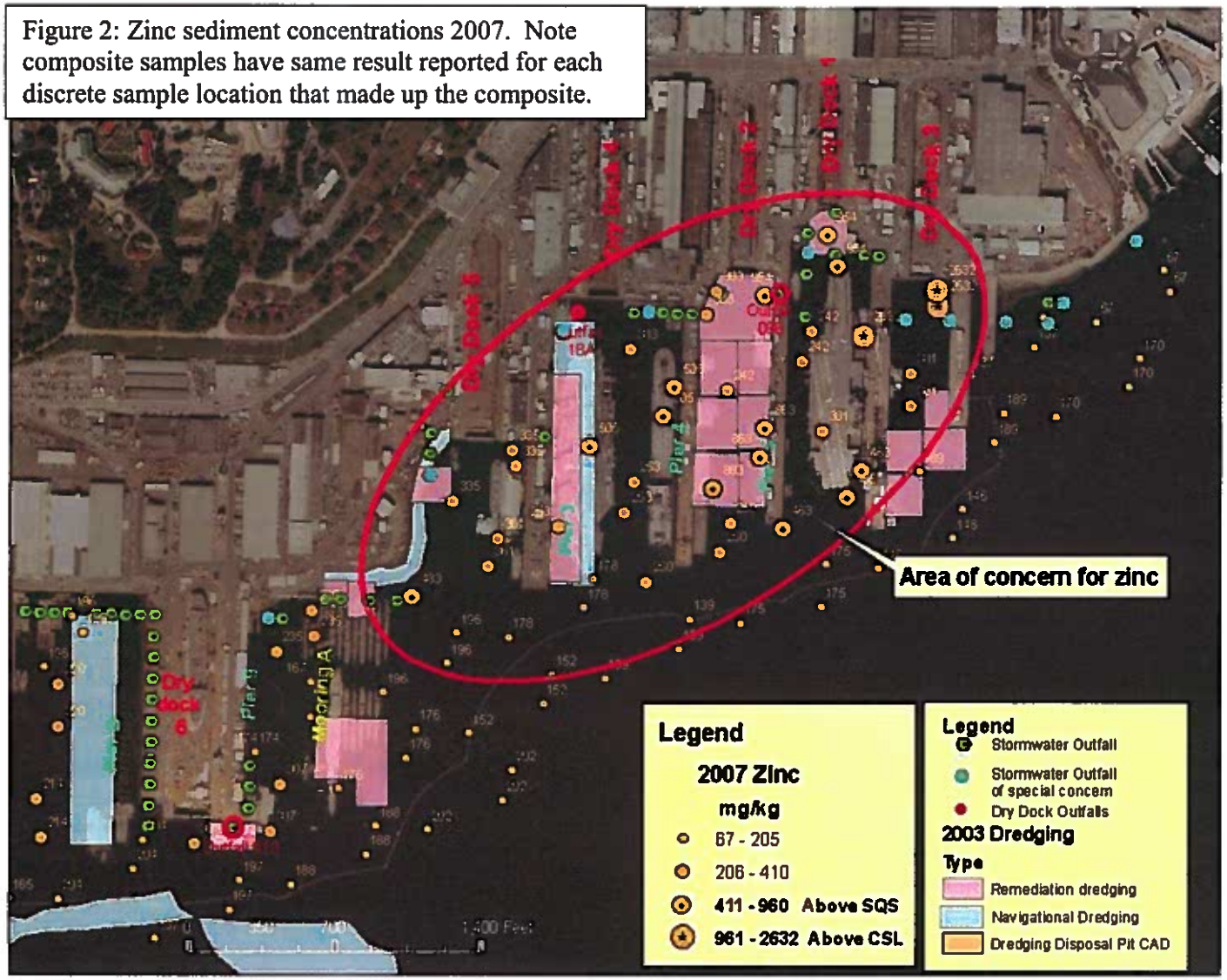


Figure 3: Copper sediment concentrations from 2007. Note composite samples have same result reported for each discrete sample location that made up the composite.

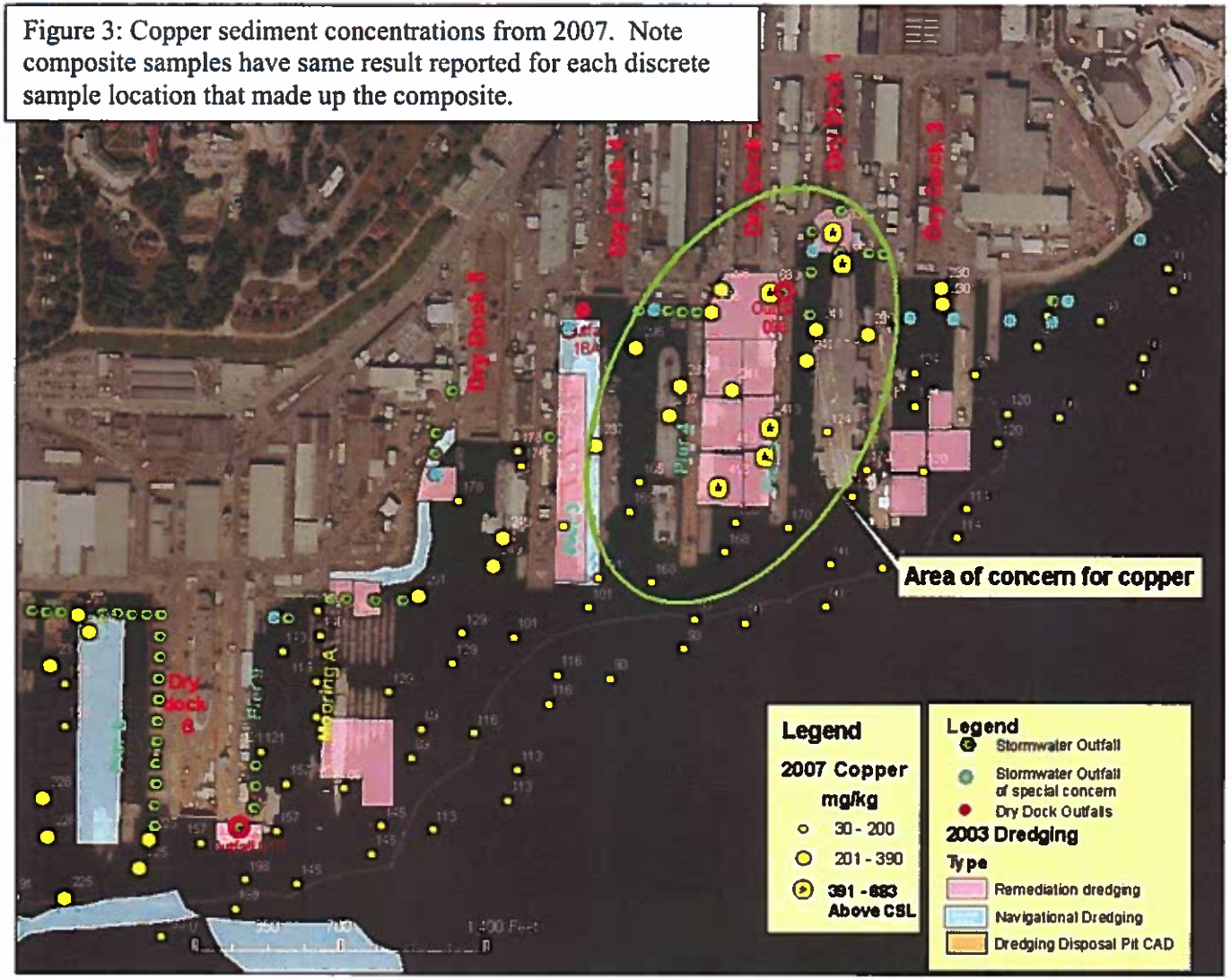


Figure 4: Mercury sediment concentrations from EIM 2007-2008.

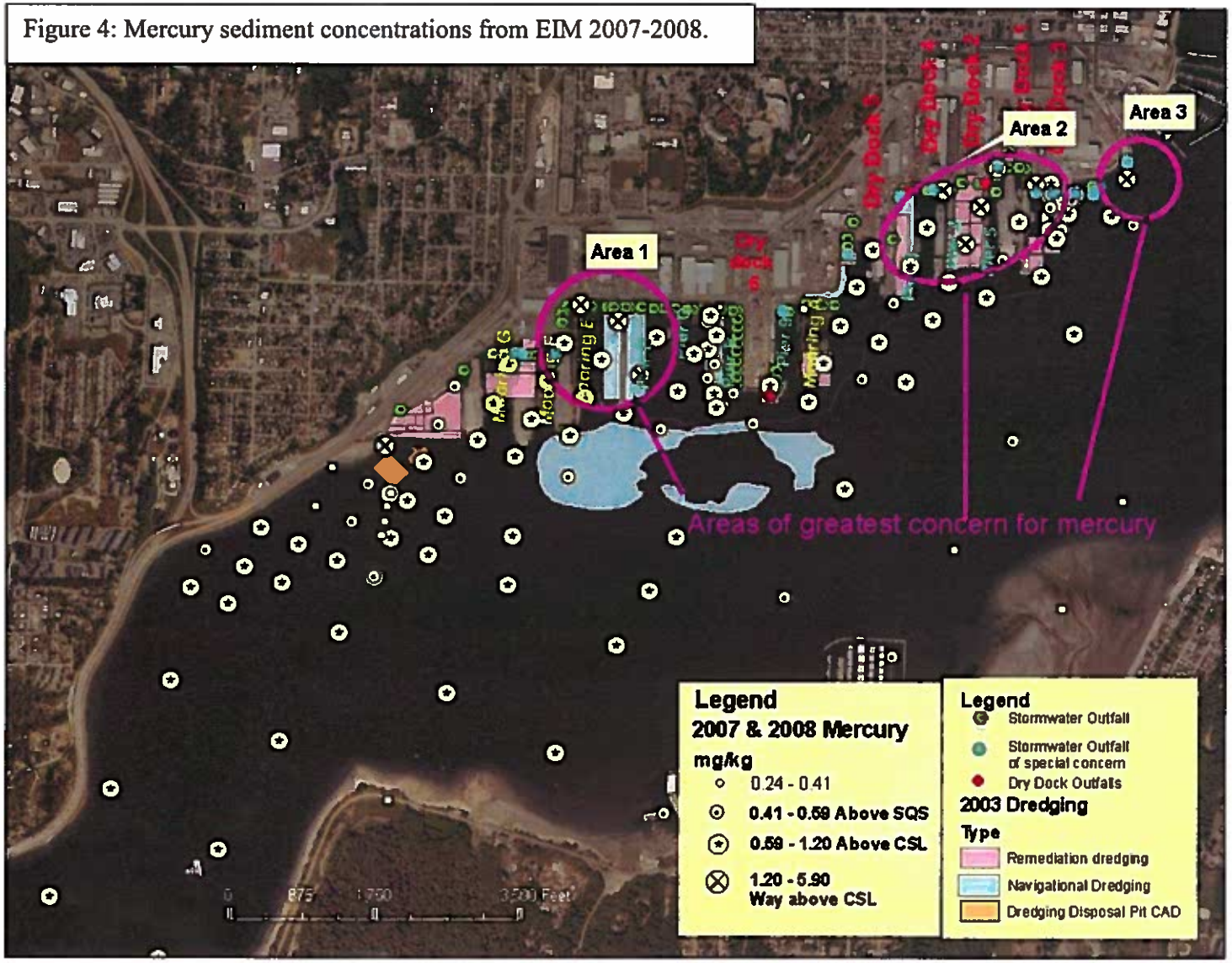
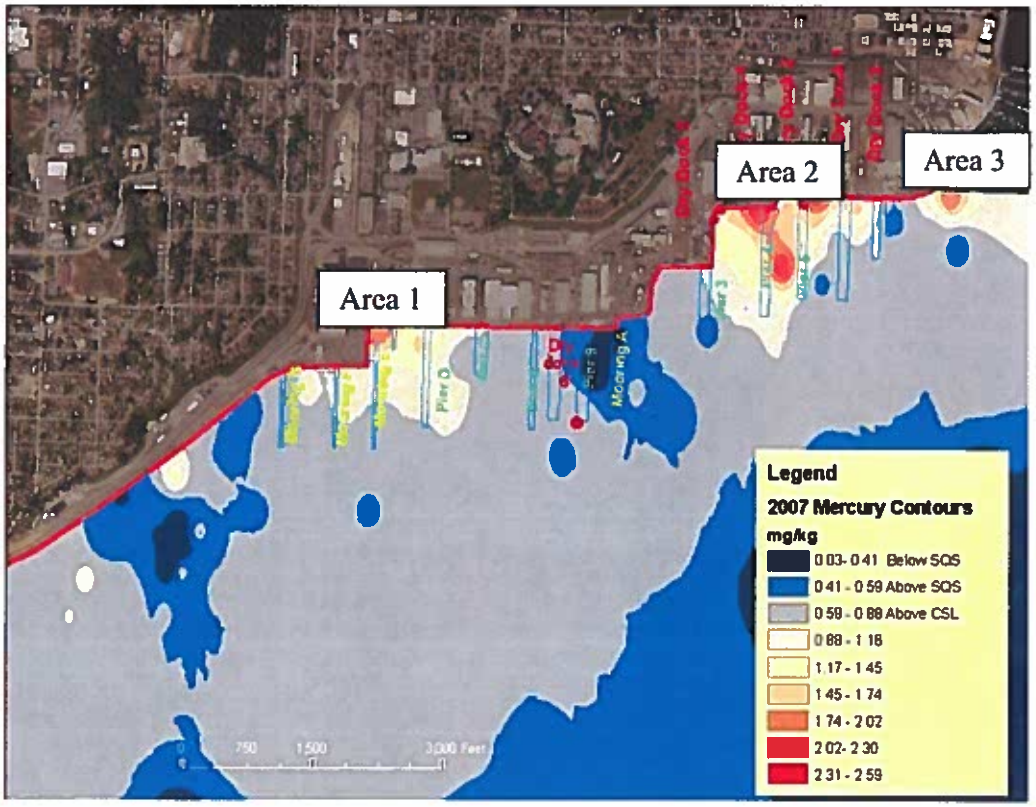


Figure 5: Priority areas to investigate potential mercury sources based on 2003-2007 OU B Marine Monitoring Reports.



Priority areas to investigate for mercury

Area 1

- Mooring E
- Pier D
- Stormwater Outfalls 13, 14, 37, 38, 39, 40, 41, 82, 83, 84, 85

Area 2

- Pier 4
- Pier 5
- Pier 6
- Stormwater Outfalls ***3***, 4, 5, ***6***, 7, ***25***, 26, 27, 28, 42, 43, ***44***, 35, 46, 48, 49, 50, 51, ***52***, 53, 97
- Dry dock Outfall 096

Area 3

- Stormwater Outfall ***1***

Bold italics indicates outfall identified by EPA as special concern.

In the past, anti-fouling paints used on ship bottoms have contained up to ½ pound of mercuric oxide per gallon of paint.

Figure 6: 2007 PCB sediment concentrations (dry weight) from EIM.

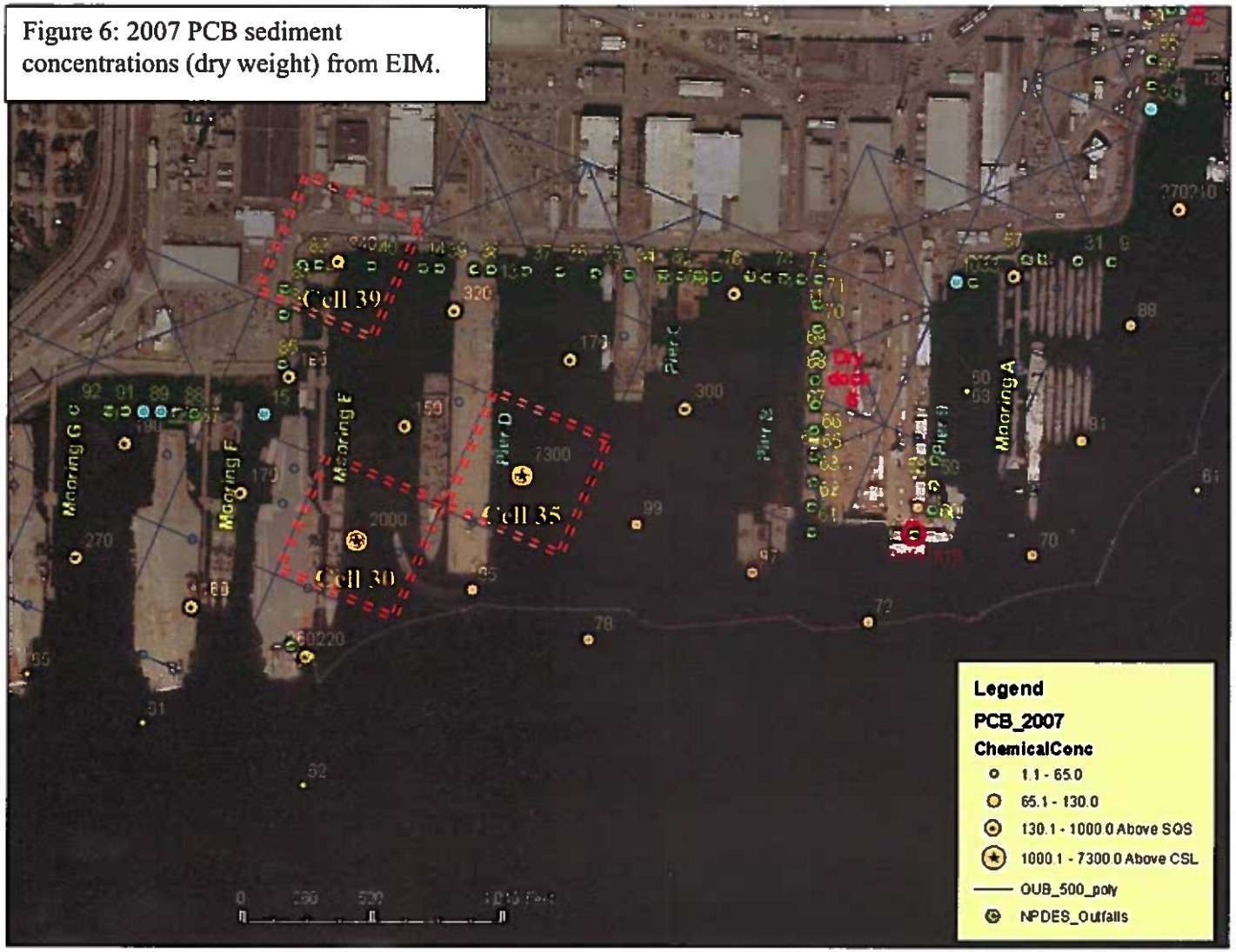
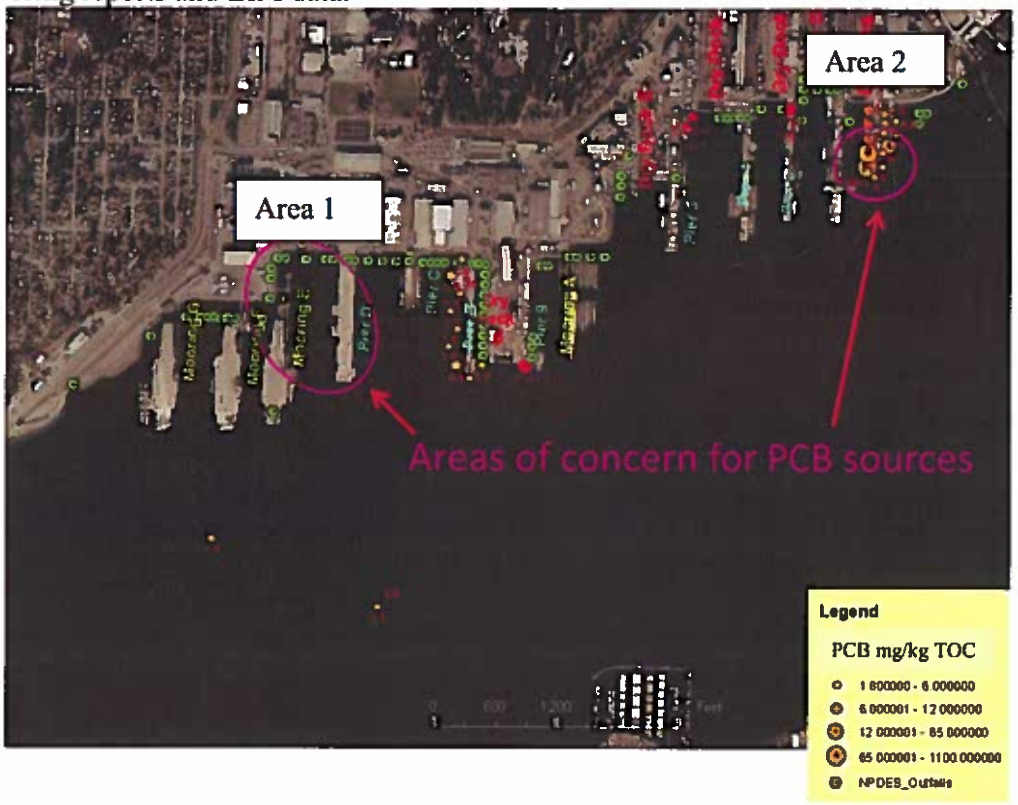


Figure 7: Priority areas to investigate potential PCB sources based on 2003-2007 OU B Marine Monitoring reports and EIM data.



Areas to Investigate for PCB

Area 1

- Pier D
- Mooring E
- Outfalls 13, 14*, ***15***, 38, 39, 40, 41, 82, 83, 84, 85.

Bold italics identifies outfalls of concern identified by EPA in permit.

* Outfall 14 has a very large drainage area – more than 4 million sq ft.

Area 2

- Pier 7
- Outfalls ***25, 95***.

Bold italics identifies outfalls of concern identified by EPA in permit.

Recommendation
Based on my review of existing information about site activities, discharge characteristics, and existing sediment data, I believe that additional monitoring is needed to determine the existence and extent of sediment impacts and the potential sources.

The request for a mixing zone in the water column seems reasonable, but it does not address impacts to sediment. Given the complexity of this site, the number of outfalls, and the lack of stormwater discharge data, I believe that an attempt to model sediment impacts would have a great deal of uncertainty. I recommend that you proceed with allowing a mixing zone for copper and zinc, but require sediment monitoring in the vicinity of the outfalls to determine if the discharges are causing sediment impacts. Sediment samples should be within 100 feet of the outfall and not be composited with other samples.

Sediment monitoring is also needed for other constituents that were identified in the ROD, such as PAH chemicals but has not been evaluated for more than 10 years.

Past stormwater discharge monitoring has been inadequate. I strongly agree with the new draft permit that requires quarterly monitoring of stormwater for copper, lead, mercury, zinc, and arsenic. This will help identify if the outfalls are potential sources of contaminants. Areas with elevated PCB or mercury concentrations, as identified in Figures 5 and 7, should have diagnostic monitoring such as stormwater sediment trap samples analyzed to evaluate possible upland sources.

Where sediment data shows exceedances of the SQS or CSL criteria for copper or zinc, laboratory bioassays may be used to evaluate whether the metals are bioavailable and causing toxicity. In areas of high copper and zinc concentrations, the overlying receiving water should be measured to evaluate whether the sediment could be a source of contamination that is causing water quality violations.

In areas where sediment concentrations exist above the SQS, additional diagnostic monitoring should be performed to determine potential sources. This may include additional sediment sampling to investigate spatial gradients, effluent monitoring at nearby outfalls, sediment trap analysis in basins that drain into the area, and evaluation of activities that may be contributing contaminants to stormwater in that area.

Below are recommendations for specific monitoring to include in the NPDES permit requirements:

Sediment Sampling

- One sediment sample within 100 feet of each of the 14 stormwater outfalls identified by EPA and at each dry dock outfall (18 samples total). The top 10 cm of sediment should

be collected. These samples should be analyzed for the 47 chemicals with SMS numeric criteria, plus conventional analytes such as TOC, grain size, ammonia and sulfide.

- An additional 20 samples between Piers 3 and 7 to be analyzed for copper and zinc. These samples should be discrete sediment samples from 0-10 cm depth. The location of the samples should be distributed to help determine spatial gradients and potential sources.

Effluent Monitoring

- Retain the quarterly stormwater monitoring that is currently in the draft permit, especially for outfalls in the eastern half of the site.
- Ensure that PCB and mercury are being evaluated in dry dock and stormwater monitoring, with a focus on areas of concern identified in Figures 5 and 7.
- In areas where BMPs are used to prevent contaminants in the stormwater, stormwater monitoring should be ongoing.
- In areas where BMPs are not an important part of pollution prevention, stormwater monitoring could be reduced once it is proven that there are low concentrations in the discharge.

Diagnostic Monitoring

- Piers 3, 4, 5, and 6 have SQS exceedances for zinc and also elevated concentrations of copper, as shown in Figures 2 and 3. Outfalls that discharge into this area should be evaluated as potential sources. A plan for evaluation and diagnostic monitoring should be developed and implemented for these discharges. The evaluation should include looking at what types of activities are occurring on the piers and in the stormwater catchment areas. For the most likely sources, diagnostic monitoring should include effluent monitoring, sediment catch basin monitoring, or additional sediment monitoring, as appropriate.
- Diagnostic monitoring should occur in areas with high concentrations of mercury and PCBs, as shown in Figures 5 and 7, to determine potential sources and prevent recontamination of cleanup actions. Diagnostic monitoring should include a review of area dockside and upland activities and applicable BMPs, effluent monitoring at identified outfalls, and stormwater solids monitoring (such as sediment traps), as appropriate.

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